Mosquito News

Issued Quarterly By
AMERICAN MOSQUITO CONTROL ASSOCIATION
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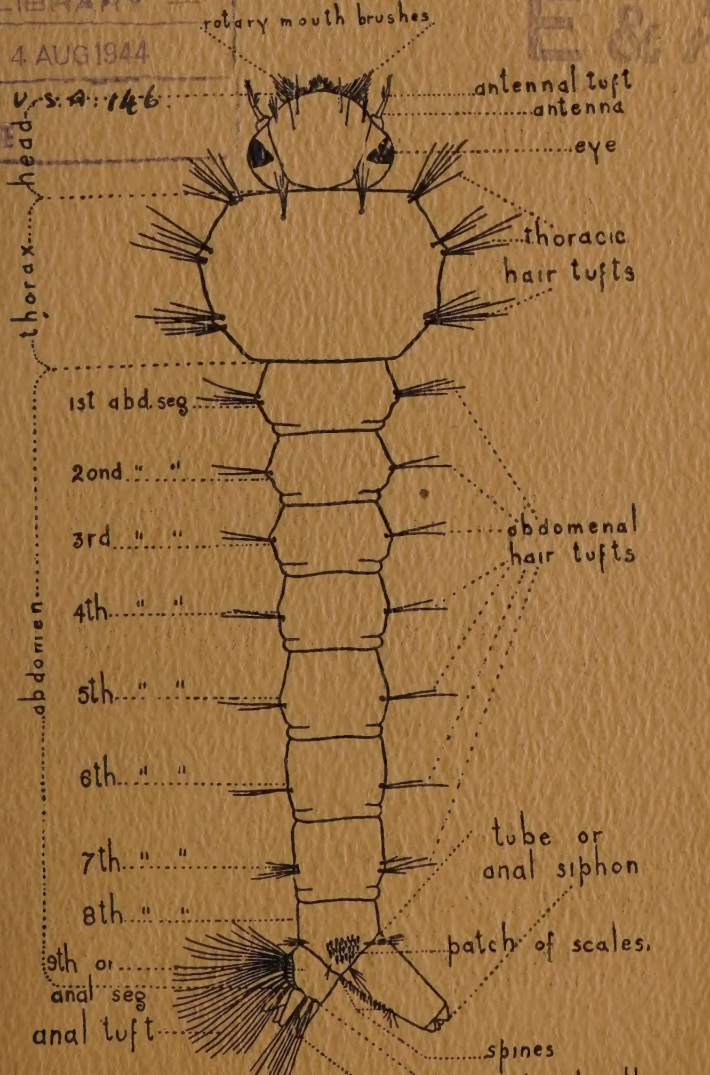

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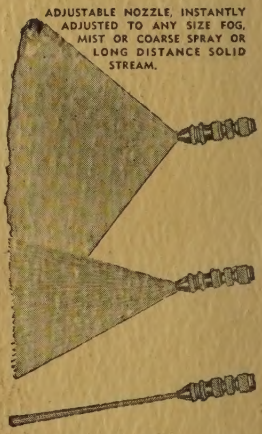

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BIOGRAPHY

WILLIAM BRODBECK HERMS

The worth of a man may be appraised in many ways. He may have contributed much to the material welfare of the public; he may have produced ideas, good or evil, which have affected men's thinking; he may as a teacher have influenced and guided young men to useful careers, and helped to mould their characters.

Although he was probably the first and is unquestionably the foremost medical entomologist in America, William Brodbeck Herms (Billy to his many friends) is above all a great human being, who has the marvelous faculty of interesting young men in his subject and stimulating them to purposeful study and productive research. The able medical entomologists he has developed at the University of California over a period of more than thirty-five years are his greatest achievement.

His own direct contributions to science are considerable, his extensive technical writings covering works on malaria, relapsing fever, poliomyelitis, typhoid, the dysenteries, and many other diseases and their anthropod vectors; in the veterinary field, on many parasites, arthropods and helminths, of domestic animals; in the economic field, the pests of coconut palms in the South Pacific, the life histories and control of termites, and many others.

The high-frequency electrical trap with a monochromatic light attractant highly selective for a specific insect, such as the artichoke plume moth, resulted from his basic studies and under his supervision, and he was probably the first to use a suction fan with an insect light trap.

His principal book, "Medical Entomology," was the first definitive book on this subject. The first edition was published in 1915, and is now about to appear in a fourth edition. Another useful book is "Mosquito Control," written jointly with Harold F. Gray, the first edition of which appeared in 1940; a second edition, revised and enlarged, is appearing in March, 1944.

Herms originally intended to be a physician, but about the time he graduated from Baldwin-Wallace College in 1902 his interest in malaria, stimulated by the new discoveries concerning its transmission by mosquitoes, caused him to concentrate on the arthropod vectors of disease. After graduate study at Ohio State and Harvard Universities, he taught zoology at Ohio Wesleyan for two years, and came to the University of California in 1908 as Assistant Professor of Entomology, becoming Professor of Parasitology and head of the Division of Entomology and Parasitology in the College of Agriculture in 1920.

The presence of a severe endemic malaria in the central valley of California gave him the opportunity to conduct what was the first definitive campaign, in the continental United States, to control malaria by the control of the **Anopheles** vector only. This campaign, at Penryn, California in 1910

(Continued on Page 46)

EDITORIAL SECTION

As never before, public attention is now focused on the control of mosquitoes and malaria, and of other insect borne diseases and their vectors. Nearly every American is now conscious of having a son or daughter, a brother or sister, or some other relative, or at least a friend exposed to the hazards of insect borne disease in some war area; and public interest in the possible local hazard presented by returning human carriers is quite generally aroused.

As a result of public interest, a marked acceleration of future work on insect borne diseases and their control now seems assured. Accurate judgment of probable trends and of sound provision for this accelerated future work must be based on true perspective.

With too exclusive preoccupation, one may easily come to assign to one's own special duties a disproportionate importance in comparison with those of one's fellow workers. Like the pendulum, the hands, the face and the works of the fabled clock, the engineer, the medical man and the entomologist are prone each to claim for his own special contribution, pre-eminent importance in mosquito control work.

Instead of fruitless debate, the best way to restore balance to our perspective is to "look at the record" by reviewing the early groping steps which, within the memory of men still living, have led from utter ignorance of the cause of mosquito borne disease to the point where medical men, engineers and entomologists are joined today in the greatest effort ever made to combat mosquitoes and malaria as well as other insect borne diseases and their vectors both in war areas abroad, and at home.

How recently these advances have come and how mutually interdependent the contributions of these three services have been, is strikingly and simply expressed in the following paragraphs quoted by permission from the book **"Fighting the Insects. The Story of An Entomologist,"** by Dr. L. O. Howard, Honorary Contributing Editor for this issue.

Dr. Howard is Dean of living American Entomogolists, and was apparently first to publish the results of experiments on the practical control of mosquitoes.

"We are fond of saying that circumstances have conspired to bring about such-and-such a result, and surely a series of different things led me naturally to take a great interest in the subject of the insect carriers of disease. There were plenty of mosquitoes at Ithaca, and long before I read Rèaumur's fascinating account of the development of the common rain-water mosquito at Paris in the middle of the 18th Century, someone had told me that the little wrigglers in buckets of rainwater and in horse troughs were young mosquitoes. I had not only studied their transformations out of mere curiosity, but I had found that in this aquatic stage they were readily killed by pouring a few drops of kerosene on the surface of the water. But of course I was only a boy, and mentioned it only to my boy friends.

"When I came to Washington I developed a slight case of malaria. I consulted a physician, who told me that it was due to my open windows at night — that the miasma came in from the Potomac flats. I shut the windows, took quinine, and got well. But I never had the slightest suspicion that there was any such thing as an Anopheles mosquito. Mosquitoes were bad in most places in those days. The New Jersey coast once was at the height of its reputation, and I remember that it was almost impossible, in many parts of the Northern States, to sit out of doors at or after dusk from late May until September.

"From time to time we received letters in Washington asking information about mosquitoes, and I published a number of notes in **Insect Life.** In 1892 I built a little house in the Onteora Club, in the Catskill Mountains, and in the summer found mosquitoes very prevalent. On my land there was a surface pool of water covering about sixteen square feet, and, remembering my boyhood experience in Ithaca, I poured kerosene on it, making a complete surface film. This not only killed the mosquito larvae, but also the

female mosquitoes which alighted on the water to lay their eggs. I read an article about this before the Buffalo Meeting of the American Association for the Advancement of Science, and the newspapers took it up. The article itself was later published in **Insect Life.**

"When I became Chief of the Service in 1894, it occurred to me that it might be a good idea to write a long and comprehensive bulletin on the subject of household insects, and this I did in collaboration with my assistants, C. L. Marlatt and F. H. Chittenden, each of us signing the portion which he contributed. Mosquitoes, the housefly, and certain other insects fell to my lot, and before writing I studied their biology rather carefully. Apparently no one had studied the development of the commonest of the rainwater mosquitoes since Rèaumur had written in Paris one hundred and fifty years before, and of course I found that in Washington things were rather different.

"So I was getting more and more interested in mosquitoes, and later worked out the life histories of several species. Among these was **Anopheles quadrimaculatus,** afterwards shown to be a malaria-carrier. Then came the announcement of Ross's discovery. I was now ready to publish a bulletin on this subject, but before I did it I sent an illustrated article on the life history of a malarial mosquito to the Scientific American. It was published and attracted much attention.

"It resulted from all this that when Dr. Walter Reed, of the U. S. Army, wanted to start a thorough investigation of Yellow Fever in Cuba at the end of the Spanish-American War, he came to my office to make a study of certain mosquitoes prevalent in Cuba, and especially of the one then known as **Culex fasciatus,** which had been suggested by a Havana physician, Carlos Finley (son of a Spanish mother and an English father), as the probable carrier of Yellow Fever. He brought with him Dr. Jesse W. Lazear and later Dr. James Carroll, who were associated with him in the famous Yellow Fever Commission. Dr. Aristides Agramonte, a native Cuban, was also a member. The work of the Reed Commission is well known. During all their investigations, Reed constantly wrote to me, not only on questions relating to the different species of mosquitoes, but also to tell me of the progress of their work.

"Just here it will be interesting to quote a letter received from Dr. Reed and dated January 13, 1901:

'Dear Dr. Howard:

I enclose a copy of the Order relating to the Protection Against Mosquitoes. Of course you have already heard from Dr. Sternberg of our complete success in repeating our former observations. The mosquito theory for the propagation of yellow fever is no longer a "theory," but a **well-established fact.** Isn't it enough to make a fellow happy? Anopheles and Culex are a gay old pair. What havoc they have wrought to our species during the last three centuries! But with Howard and kerosene we are going to knock them out.

With best wishes,

Sincerely yours,

Walter Reed.'

"This is all very interesting and has much historical value. W. C. Gorgas, who was then a major in the Medical Corps, was put in charge of the clean-up of Havana on the basis of the just proved carriage of yellow fever by mosquitoes.

"Shortly after this the United States began the construction of the Panama Canal. The principal sanitarians of the country, remembering the disastrous ending of the effort made by the French under de Lesseps to construct a canal there, were greatly exercised over the sanitary aspects of the problem, and just at the time when the Panama Canal Commission was authorized by Congress, a committee of medical men went before President Roosevelt to urge the appointment of a thoroughly competent sanitarian as a member of the Commission. I shall tell in another chapter the story of this interesting interview. The world knows that Colonel Gorgas, fresh from his clean-up of Havana, was given full charge of the sanitary work in Panama.

"Before he started for the Isthmus, Colonel Gorgas called at my office, and brought with him Mr. J. A. LePrince, an engineer who had been with him in his Havana work, and we talked at some length of mosquitoes and mosquito remedies. I was then planning the Carnegie monograph, and asked Colonel Gorgas if he would have some one collect for me all the different species that could be found down there. He smilingly replied, 'I'll have to turn that over to Mr. LePrince.' And LePrince, with an amiable grin said, 'Well, Doctor, I'll have to do it right away, because in a few weeks there won't be any mosquitoes left.' I tell this as indicative of the confidence with which the two men went to work. In a book published some years later by Mr. LePrince and Dr. Orenstein I tell this story in the introductory note that I wrote for the volume, at their request.

"It seems strange that the possible usefulness of economic entomology in the World War was not at once appreciated.

"The United States government was much slower (than England) in accepting the offers of numerous trained economic entomologists who were anxious to be of service. Some enlisted in the ranks, and their valuable knowledge was not used. It seemed to some of us that in certain respects it was unfortunate that Dr. Gorgas should have been the Surgeon-General of the Army, for he seemed indifferent as to malarial probabilities — for example, in his selection of many of the great concentration camp sites. A number of these were placed at points where mosquitoes, including Anopheles, were notoriously abundant. I imagine that it was his success in insect control in Panama that brought about this apparent indifference. When our country was getting ready, I wrote him that there were many men, well trained in applied entomology, who could be used to advantage and who were anxious for service. Possibly he never saw my letter, but I received a reply from his office, signed by one of his assistants, stating that what they needed was men trained in sanitary engineering, such as they had employed at Panama, but that they did not need entomologists — men 'trained to count the spots on a mosquito's wing.' This seemed stupidly absurd to me, since it was perfectly obvious to a clear mind that as soon as a disease is discovered to be carried by an insect, almost the first man to be called in is the man who has been trained in insect life and the best ways of controlling it. Later, however, there was something of a change. Van Dine and Herms were commissioned and well placed in two of the big camps near San Antonio. Middleton, although not commissioned, was used in the same capacity in a more northern camp."

NEWS OF THE ASSOCIATION

ANNUAL MEETING

A business meeting of the association was held at the Hotel Madison, Atlantic City, N. J. on March 16, 1944, in accordance with the notice sent to all members on February 2. This was actually the 1943 Annual Meeting, which had been postponed until the time of the annual meeting of the New Jersey Mosquito Extermination Association, in order to provide for a saving in travel by making it possible for the members to attend both meetings at the same time and place.

The new constitution, copies of which were distributed with the notice of February 2, was adopted, the vote being 45 to 3 in favor of adoption (active members only having the right to vote). This document officially changed the name of the association to "American Mosquito Control Association" and provided for membership of persons engaged or interested in mosquito work without regional limitation. Classes of membership are active, associate, and honorary.

The Constitutional Committee (Dr. E. N. Cory, Chairman, Mr. R. E. Dorer, and Mr. R. L. Vannote) which drafted the constitution, had previously been directed to proceed with the drawing up of a set of by-laws when and if the constitution was adopted.

Officers and committees were elected as follows:

President—Robert L. Vannote, New Jersey.
1st Vice Pres.—Robert D. Glasgow, New York.
2nd Vice Pres.—Perry W. Ruth, Virginia.
Sec.-Treas.—Thomas D. Mulhern, New Jersey.

Executive Committee:

Officers as above, and
Robert C. Botsford, Conn., President 1943.
C. T. Williamson, N. Y., Advertising Manager, Mosquito News.
Major Herman Fellton, N. Y., U.S.P.H.S., Member at large.
Paul L. Rice, Delaware, Member at large.

Publications Committee:

Robert D. Glasgow, Editor.
C. T. Williamson, Advertising Manager.
Thomas D. Mulhern, Secretary-Treasurer.
Major Herman Fellton, U.S.P.H.S., Member at large.
Robert Matheson, New York, Member at large.

Honorary members were elected upon recommendation of the Executive Committee, each receiving the unanimous vote of the membership, as follows:

L. L. Williams, U.S.P.H.S., Washington, D. C.
Thomas J. Headle, founder and first president of the association, Rutgers University, New Brunswick, N. J.
W. B. Hermes, University of California, Berkeley, Cal.
J. A. LePrince, U.S.P.H.S. (Ret.) Memphis, Tenn.

New members accepted since the last regular meeting of the association were confirmed by unanimous vote, as follows:

Active

I. W. Bales, N. J.
A. L. Berti, Venezuela
L. Dalecour, Haiti
F. L. Hayes, Cal.
J. H. Huber, Ore.
V. S. Minnich, Fla.
R. H. Potts, La.
H. R. Rich, Ill.
T. G. Roehner, N. Y.
C. S. Strickland, Fla.
F. H. Taylor, Australia
R. Wilson, La.
L. T. Woosley, Fla.
H. L. Haynes, N. J.
B. B. Pepper, N. J.
E. J. Hansens, N. J.
J. H. Spackman, Pa.
M. Merron, Ga.

Associate

W. C. Baker, Texas
P. B. Brockway, Ohio
C. B. Branan, Fla.
I. W. Gilbert, Ft. Sheridan, Ill.
C. M. Gjullin, Ore.
D. Lincicome, La.
D. M. Rees, Utah
C. Richardson, La.
A. R. Roth, La.
F. H. Stutz, Fla.
W. Sullivan, Ill.
Mrs. C. C. Webber, Minn.
W. W. Yates, Ore.
W. K. Delaplane, Ill.
E. J. Gerber, Va.
W. H. W. Komp, Canal Zone
M. M. Cole, Cal.
Foo Kau Lee, Hawaii
H. Morlan, Texas
M. Petrakis, Ark.
A. Miller, La.
J. V. Osmun, N. Y.

At the Executive Committee meeting held April 27, additional members were accepted as follows:

J. E. Noonan, N. Y., Associate.
Elizabeth Marvin, Minn., Associate.
J. M. Henderson, Ga., Active.

The treasurer presented a detailed report, which may be summarized as follows:

Cash Balance on hand, November 12, 1942	$ 120.20
Receipts, to Feb. 29, 1944	1098.65
Expenditures, to Feb. 29, 1944	938.92
Cash Balance on hand March 1, 1944	279.93
Accounts Receivable, March 1, 1944 (incl. 1944 dues)	894.43
Accounts Payable, March 1, 1944	190.28
Net Worth, March 1, 1944	704.15

Income has been chiefly from membership dues, subscriptions, and advertising in Mosquito News. Expenditures have been chiefly those incurred in publishing Mosquito News, and in mailing costs and clerical supplies. Officers and committee members have contributed their services and travel expenses, as well as practically all of the clerical and stenographic services required in the conduct of the association business.

April 27th Meeting of Executive Committee

The meeting was called by President R. L. Vannote at the Hotel New Yorker, for the primary purpose of considering the suggestions offered by Dr. Glasgow as chairman of the publications committee, for the improvement of Mosquito News, and for changes in the constitution which he deems necessary to place the proposed improvements in effect. He suggests:

1—That Mosquito News be modified to follow very closely the pattern of the Journal of Economic Entomology and similar publications, and that the constitution be modified to follow that of the American Association of Economic Entomologists.

2—That provision be made for the formation of regional branches of the association, and that the Eastern Association be reorganized as Branch No. 1, and encouraged to publish in Mosquito News an account of its activities at the same time underwriting the cost of such publication.

3—That affiliation be established with the other organizations interested in mosquito work, and that they be encouraged to publish in Mosquito News.

4—That consideration be given the securing of an endowment to permit rapid expansion of the publication without the presently existing financial limitation which prevents the increase in size of the journal.

5—That the association become incorporated, thus relieving the officers of a part of the financial responsibility entailed in the publishing of a journal.

6—That Mosquito News be published by a small and continuing Editorial Board thus providing for a continuous editorial policy, and that a large Publications Committee be formed, of at least 10 members, giving wide representation for the region covered by the association and including leaders in the various phases of mosquito control.

These matters are of such momentous importance that it was decided to take no immediate action upon them, but to proceed to publish Mosquito News for June following the same style as heretofore. Meanwhile ,the publications committee may complete its plans in detail, and the constitution committee can study the various items proposed and prepare recommendations for presentation to the executive committee and to the association.

Respectfully submitted,

THOMAS D. MULHERN, Sec.-Treas.

REVIEW OF "A SYMPOSIUM ON A NATIONAL MALARIA PROGRAM FOR THE CONTROL OF MALARIA,"

presented at the joint session of the National Malaria Society and the American Society of Tropical Medicine, Cincinnati, Ohio, November 18, 1943. Journal National Malaria Society, 3: 1-73, 1944.

By ROBERT L. USINGER, P.A. Sanitarian (R), U.S. Public Health Service

With World War II, malaria has achieved the dubious distinction of being the number one disease of the world. The importance of the disease has been well known to malariologists for many years but the significant point for the future of malaria control is that its importance is now becoming apparent at first hand to a large proportion of the human race. This tremendous increase in every day knowledge of malaria coupled with the epoch making advances in control methods are a challenge to malariologists. The stage is set for the greatest all-out attack on a disease in the history of preventive medicine. Rising to the occasion, the National Malaria Society gives us this National Program for the control of malaria.

1. American Mobilization for the Conquest of Malaria in the United States. By Brig. Gen. J. S. Simmons, M.C., U.S.A.

In his presidential address General Simmons introduces the Symposium and suggests a new goal for the future — namely, the conquest of malaria in the United States. He proposes a National Program for Malaria Control, a coordinated effort by all agencies to make the United States a malaria-free country.

2. The Malaria Control Program of the Army. By Major O. R. McCoy, M.C., U.S.A.

The two phases of the Army malaria control program are: The protection of soldiers at training camps and bases and the protection of troops in forward areas and in combat. Success of the Army program is indicated by a comparison with monthly malaria admissions per 1000 per annum for the last war in the continental United States. Peak rates were over three times as great in 1917 as in 1941 and over twenty times as great in 1919 as in 1943. The malaria control organization of the Army consists of malariologists, survey units, and control units. The responsibility of the Army in helping prevent the spread of malaria by returning military personnel is stressed.

3. The Malaria Control Program of the Navy. By Commander O. J. Brown, M.C., U.S.N.

The malaria control programs of the Army and Navy were developed jointly, even to the inclusion of comparable equipment, but the Navy program differs in details of organization. The Construction Battalions include sanitary sections of 110 men completely equipped for malaria control and small, highly mobile control teams. Much attention is being given to the rehabilitation of malaria cases.

4. The Malaria Control Program of the U. S. Public Health Service, among Civilians in Extra-Military Areas. By Senior Surgeon (R) Stanley B. Freeborn, U. S. Public Health Service.

The program, Malaria Control in War Areas, is responsible for the protection of troops and vital war workers in the vicinity of war establishments in cooperation with state boards of health. Funds, equipment, and consultation along technical and policy making lines are provided by the Public Health Service. The organization, procedure, and scope of the work are discussed. Mobile malaria control units have been outfitted recently as "circuit riders" to cover General Hospitals, Prisoner-of-war Camps, and Debarkation centers, even outside of malarious areas, so that, without relaxing, the original mandate of protection of troops from civilian malaria the civilian population may also be protected from troop-borne malaria.

5. Malaria Control Activities of the Pan American Sanitary Bureau. By Hugh S. Cumming.

The development of the Pan American Sanitary Bureau is outlined from 1901 to date. Work accomplished includes publication of a Monthly Bulletin and many other contributions to the literature of malariology. The Pan American Committee on Malaria has gathered valuable information on malaria and has paved the way for further advances. In addition to its activities in the coordination of Pan American malaria control and dissemination of new information, active cooperation has been given to field projects throughout Latin America by traveling representatives of the Pan American Sanitary Bureau.

6. Malara Control Activities of the Institute of Inter-American Affairs. By G. C. Dunham.

Permanent mosquito control measures throughout Latin America under the Inter-American Cooperative Health Services are described. Work is carried on in cooperation with the Rubber Development Cooperation around airports, and along the Pan American Highway and the Emergency Military Highway. Facilities were greatly augmented when the Brazilian staff, equipment and buildings of the Malaria Service of the Northeast and the Institute de Patalogia Experimental Evandro Chagas in Belem were assigned to the Amazon project of the Cooperative Services after the eradication of **Anopheles gambiae**. The Health and Sanitation Division of the office of Coordinator of Inter-American Affairs, with representatives of the National Department of Health of each country is an important achievement in international public health.

7. Facilities for the Training of Malariologists in Military and Civil Institutions. By H. E. Meleney.

Most of the training of malariologists since the outbreak of the war has been conducted by the Army, Navy, and Public Health Service in cooperation with the T.V.A., the Florida State Board of Health, and the Rockefeller Foundation. Army training is carried on at Carlisle Barracks, Pennsylvania, the Army Medical School, Tulane University, T.V.A., The Florida State Board of Health, and the Health and Sanitation Division of the Office of Coordinator of Inter-American Affairs. In addition, Survey Units receive special training and a new school for malariology has been set up by the Army in Panama.

Navy training is centered at the Navy Medical School, at Quantico, Virginia, and at New River, North Carolina. A field course is given in the South Pacific. Training for Construction Battalions is carried on at Camp Peary, Virginia.

Training in malariology by the U. S. Public Health Service is located at the Atlanta headquarters of the Malaria Control in War Areas program. Visits are made to the Malaria Investigations Laboratory of the National Institute of Health at Columbia, South Carolina and to field training areas where actual malaria control operations are studied.

8. Contributions of the Bureau of Entomology and Plant Quarantine of the Department of Agriculture to the National Program for the Control of Malaria. By F. C. Bishop.

The Bureau of Entomology pioneered the study of mosquitoes and mosquito control in the United States. From the first work of L. O. Howard in 1892 to the present day, the Bureau of Entomology and Plant Quarantine has contributed substantially to our knowledge of mosquitoes and mosquito control. Outstanding contributions during the present war include toxonomic survey and identification work, and development of spectacular larvicides, adult sprays, aerosols, and repellents. Insecticidal research is carried on at the Orlando, Florida laboratory under contract with the office of Scientific Research and Development.

R. L. Usinger, P. A. Sanitarian (R), USPHS

9. The Activities of the National Research Council in the National Program for the Control of Malaria. By G. A. Carden, Jr.

The National Research Council was created in 1916 as the active agent of the National Academy of Sciences. On September 3, 1941, the Chairman of the Division of Medical Sciences called the first Conference on the Chemotherapy of Malaria. Later, in connection with the Office of Scientific Research and Development, a Board for the Coordination of Malaria Studies was set up with the following four panels: (1) Synthesis of antimalarials; (2) Biochemistry of antimalarials; (3) Pharmacology; (4) Clinical Testing. Results include data on about 6000 new drugs which have been tested on one or more parasites. Exchange of information through the office of the Survey of Antimalarial Drugs conserves manpower by avoidance of duplication of effort. It is hoped that out of this large coordinated effort an effective field prophylactic will be discovered.

10. A Proposed Program to Prevent the Spread of Malaria in the United States from Infected Individuals returning from abroad. By W. A. Sawyer.

The danger of introduction of exotic strains or vectors of malaria is emphasized and the following measures are proposed to minimize introduction of infection into communities: (1) All individuals with malaria among returning military personnel should be treated until clinically free of the disease before discharge; (2) Special anopheline surveys and control should be undertaken to minimize the spread of malaria from places in which returning personnel with malaria are concentrated; (3) The malaria patient on discharge from a military hospital should be notified in writing of the diagnosis and the species of **Plasmodium** involved and should be instructed to consult a physician and show him the communication on the occasion of any subsequent illness within a year; and any reports requested by civilian health authorities should be supplied; (4) Strong efforts should be made to educate physicans in the diagnoses and treatment of malaria and the fundamentals of prevention.

Measures to make the community non-infectible are listed as follows: (1) Extensive malaria and anopheline surveys, particularly the latter, must be

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BIOGRAPHY

(Continued from Page 38)

was followed by many others, and the stimulus of his work led finally to the establishment of some 26 mosquito abatement districts in California.

In the first World War he was a Major in the Sanitary Corps, U. S. Army, handling malaria control at the Port of Embarkation, Newport News. In 1943 he was called back into active service as Lieutenant Colonel, and until retired in October was assigned to teaching duties at the Army Medical Field Service School at Carlisle Barracks, Pennsylvania.

Professor Herms received the honorary degree of Doctor of Science from Baldwin-Wallace College in 1935. He is a Fellow of the American Association for the Advancement of Science and the California Academy of Sciences, and a member of the Entomological Society of America (President, 1940), the Association of Economic Entomologists (President, 1928), the American Society of Parasitology, the American Society of Tropical Medicine, etc. For many years he has been Consulting Entomologist to the California State Department of Public Health. He has been a Trustee of the Alameda County Mosquito Abatement District since its organization in 1930.

His principal hobby is the Boy Scout movement, and for many years he has been President and guiding spirit of the Berkeley-Contra Costa Area Council. In 1937 the City of Berkeley conferred upon him the Banjamin Ide Wheeler award, granted occasionally to its most distinguished and useful citizen. In 1935 the Republic of France awarded him the Croix de Chevalier du Merite.

made if malaria is not to take us by surprise; (2) Suppression of the breeding of dangerous anopheline species by the destruction of the larvae where their presence has been revealed by the surveys should be the main dependence for preventing the establishment and spread of the introduced infection; (3) As supplementary measures for protection against infected **Anopheles,** the effective screening of houses and the spray-killing of adult mosquitoes should be instituted and popularized through propaganda.

Finally, the need for a master plan for the eradication of malaria or its vectors or both, is stressed.

11. A Program for the Eradication of Malaria from Continental United States. By Assistant Surgeon General J. W. Mountin, U. S. Public Health Service.

As a climax to the Symposium, Dr. Mountin proposed a bold plan, originally advanced by Dr. L. L. Williams, Jr. of the Public Health Service, for the eradication of malaria from continental United States as an aggressive answer to the problem of returning malaria carriers. It is pointed out that malaria has reached the lowest ebb in history and the cyclic upswing which previous experience had taught us to expect in 1941-42 failed to materialize.

It is not proposed to eradicate malaria vectors, but only to reduce anopheline densities below the point where transmission is likely to occur or to institute protective measures against the bites of infected mosquitoes in the permanently endemic malarious areas of the country.

Forty-two counties in the United States from 1938 to 1942 had an annual average mortality rate of over 20 per 100,000 population. The average estimated expenditure per county per year is $125,000 and it is felt that three years would be an adequate trial period. Such an undertaking would require the fullest cooperation of Federal, State and local agencies. Dr. Mountin asks that serious consideration be given this proposal, keeping in mind that such a favorable opportunity for the eradication of malaria may not occur again for a generation.

CALIFORNIA MOSQUITO CONTROL ASSOCIATION CONFERENCE

By HAROLD F. GRAY

The California Mosquito Control Association held a very successful two-day conference at the University of California, Berkeley, on February 28-29, 1944. There was a total attendance of about 180, of which more than one-half were officers in the Army and Navy.

The high lights of the meeting were the papers and discussions presented by Sanitary Engineer Nelson H. Rector, U. S. Public Health Service, Office of Malaria Control in War Areas, at Atlanta, Georgia, and by Senior Entomologist Harry H. Stage, U. S. Bureau of Entomology and Plant Quarantine, Washington, D. C. Mr. Rector presented a paper on "The use of ditch lining, underground drains and sanitary fills for malaria and mosquito control," illustrated by lantern slides.

Mr. Stage presented a paper on "Mosquito repellents and their uses," which was illustrated by projected kodacrome photographs; a brief discussion on new larvicidal materials, and a discussion on the proposed reorganization, on a national scale, of the Eastern Association of Mosquito Control Workers.

"The Aedes aegypti program of the U. S. Public Health Service," a paper prepared by Asst. San. Engr. Harvey F. Ludwig, U. S. Public Health Service, Atlanta, Georgia, was read by P. A. Sanitarian W. C. Frohne, U.S.P.H.S., San Francisco. This paper was illustrated by an excellent motion picture film prepared by the Service, and by slides.

A symposium on diseases transmitted by mosquitoes in the Pacific area (malaria, dengue, filariasis and encephalitis) provoked considerable discussion, as did the symposium on mosquito control problems in the South Pacific area.

An interesting feature of the meeting was the Question Box and Panel Discussion held on Monday evening. The panel which answered questions consisted of Prof. W. B. Herms, Chairman; Lt. Cmdr. Dwight L. Wilbur, M.C., U.S.N.R.; H. H. Stage; Prof. Don M. Rees; W. C. Reeves; Nelson H. Rector; Harold F. Gray; M. E. Stewart.

A large part of the final afternoon was given over to laboratory demonstrations of various important mosquitoes, and the demonstration of various materials and equipment.

AN ANNOTATED LIST OF THE MOSQUITOES OF VIRGINIA

By

R. E. DORER, W. E. BICKLEY AND H. P. NICHOLSON

U.S.P.H.S., Malaria Control in War Areas

Observations on the mosquito fauna of Virginia have largely been made in the southeastern part of the State primarily because such studies usually are associated with control work. Now, as well as in the past decade, mosquito control of all types has been concentrated in the Hampton Roads area. Recently the water chestnut areas of the Potomac in which **A. quadrimaculatus** breeds so abundantly have had the attention of Malaria Control in War Areas authorities.

The following list has been compiled from records obtained from all likely sources within the State, but the number of records in the above areas constitutes well over 90% of the total. This fact should be considered with reference to statements as to species distribution.

Aedes:

A. aegypti (L). Common in Southeast.

A. atlanticus D. & K. Fairly common.

A. canadensis (Theob.). Fairly common.

A. cantator (Coq.). Rare. Larvae found at Camp Peary (C. K. Dorsey); other records probably exist but have not been verified.

A. dupreei (Coq.). Rare. Lake Drummond, Aug. 10, 1935, Alan Stone. Also reported from Camp Peary.

A. fulvus pallens Ross. Rare. Single female from light trap, Camp
A. bimaculatus of authors Pendleton, June 21, 1943, H. P. Nicholson.

A. mitchellae (Dyar). Rare in traps in Hampton Roads area. First taken as larvae, 1942. Fairly common in larval collections.

A. sollicitans (Walk). Very common in coastal and bay areas; a predominating pest. Taken occasionally in traps at Fort Belvoir.

A. sticticus (Meig.). Rare. Woodstock, Feb. 6, 1903, F. C. Pratt, U. S. N. M. det. by H. G. Dyar.

A. taeniorhynchus (Wied). Very common in coastal and bay areas; a predominating pest. Taken occasionally in traps at Fort Belvoir.

A. triseriatus (Say). Fairly common in some localities.

A. trivittatus (Coq.). Rare. Schoolfield, Pittsylvania Co., July 9, 1943, H. P. Nicholson. Waynesboro, Aug. 7, 1943, W. E. Bickley. Probably occurs in Southeast.

A. vexans (Meig.). Common and widely distributed.

Anopheles:

A. atropos D. & K. Rare. Larvae collected at Onley (Eastern Shore) Sept. 9, 1932, F. C. Bishopp and G. H. Bradley.

A. crucians bradleyi King. Common in Hampton Roads area. Very common at Camp Peary.

A. crucians crucians Wied. Common in Hampton Roads area and rare in Northern Virginia. Many adults taken in coastal and bay areas are probably **A. crucians bradleyi** King.

A. barberi Coq. Rare (Williamsburg area and Princess Anne County). Larvae collected from tin cans in woods.

A. punctipennis (Say). Common and widely distributed. Appears to be the most abundant anopheline outside Hampton Roads area except in water chestnut areas of Potomac.

A. quadrimaculatus (Say). Common. Most abundant in southeastern Virginia, Eastern Shore and water chestnut areas of Potomac. Doubtless the most common anopheline at many places in Hampton Roads area. Well distributed.

A. walkeri Theob. Rare. Taken occasionally in traps in Northern Virginia and Cape Henry.

Culex:

C. apicalis Adams. Larvae fairly common but adults rare.

C. erraticus D. & K. Common in large lakes and reservoirs in association with quads.

C. peccator D. & K. Rare. Single female reported from Camp Peary. Sept. 1943, C. K. Dorsey.

C. pipiens L. very common and widely distributed. Probably the most important pest except in coastal and bay areas.

C. quinquefasciatus (Say). Rare. A single male specimen from the Norfolk area has been identified by examination of genitalia (H. P. Nicholson). Preparations of male genitalia, including males reared from questionable larvae have in other cases proven to be **C. pipiens.**

C. restuans Theob. Common and well distributed.

Syn. **C. territans** Walk.

C. salinarius Coq. Common and well distributed. Very abundant in water chestnut areas of Potomac.

Mansonia:

M. perturbans (Walk.). Fairly common. Breeds extensively in Cape Henry area. Collected at widely separated points.

Megarhinus:

M. septentrionalis D. & K. Rare. Taken in Hampton Roads area.

Orthopodomyia:

O. signifera (Coq.). Rare. Taken in Hampton Roads area and Northern Virginia.

Psorophora:

P. ciliata (F.). Fairly common and well distributed.

P. confinnis (L.-A.). Syn. **P. columbiae** (D. & K.). Common in Hampton Roads Area. Occasionally a serious pest. Trapped in Northern Virginia.

P. cyanescens (Coq.). Rare. Rose Hill, Lee Co., Aug. 10, 1943. Single female. H. P. Nicholson.

P. ferox (Humb.). Fairly common in Hampton Roads area and well distributed throughout State.

P. horrida (D. & K.). Rare. Woodstock, Aug. 4, 1904, F. C. Pratt, U.S.N.M. det. by H. G. Dyar.

P. howardii (Coq.). Fairly common.

P. varipes (Coq.). Rare. Princess Anne Co. near Norfolk Airport, July 20, 1943. Four females. Biting. H. P. Nicholson. Camp Lee, July 20, 1943. Single female, biting. E. J. Gerberg.

Culiseta:

C. inornata (Will.). Fairly common especially in Cape Henry area. Larvae hard to locate.

C. melanura (Coq.). Fairly common and well distributed.

Uranotaenia:

U. sapphirina (O.-S.). Common in lakes and reservoirs and in water chestnut areas of Potomac. Thousands taken in traps in Northern Virginia.

SIMPLE FIELD AND LABORATORY TESTS OF LARVICIDES

H. L. FELLTON

The ultimate criterion of the effectiveness of a larvicide is its ability to kill mosquito larvae. A larvicide, properly applied in sufficient quantity to breeding places, should result in effective control of mosquito breeding. When this does not occur, it indicates that something is wrong with the larvicide. Larvicides being used in control operations should be constantly checked, particularly in the field, to determine their effectiveness.

Paris Green

Paris green which conforms to proper specifications as to chemical structure and particle size is known to be toxic to anopheline larvae when applied in very small amounts. Laboratory experiments have shown clearly that amounts of paris green so small as to escape visibility under the hand lens may poison all larvae in a container (Barber). From other laboratory experiments it may be assumed that the minimum lethal dose for fourth instar **A. quadrimaculatus** larvae is less than 0.0000004 gms of paris green.

An approximation of the relative toxicity of different paris green dusts may be obtained as follows: A larva is placed in a Petri dish containing water and observed under a hand lens. When it is feeding well, a very small amount of paris green is carefully applied to the water surface near the larva. As soon as it has ingested a small particle, it is removed by pipette to a second dish, washed, and put into a third where the time of its survival is noted.

Pan toxicity tests may be made to ascertain effectiveness. Ten or more second, third and fourth instar larvae are introduced into a pan partially filled with water, and the larvicide in the same paris green-diluent mixture and at the same rate of application as that to be used in the field is dusted over the surface of the water. An effective paris green should give a complete kill within two hours.

Dosages of larvicide determined by laboratory means are not always effective under field conditions, where the spread of the dust may be obstructed by scum, algae, floatage, and other factors. An effective field dose may be determined by sampling the larval population at specific points in

breeding areas before and after application of known dosages of the larvicide. A light treatment should be tried first and the dosage gradually increased until it is found to be effective. Checking of mortality should be performed on the day following the application.

Petri dishes or other containers partially filled with water and with a known number of larvae in each may be placed at various points in the breeding area shortly before applying the larvicide. The dishes can be examined after the dusting and the precentage of mortality determined.

Petroleum Oil

Petroleum oils do not, as many people believe, kill mosquito larvae and pupae by suffocation. The volatile components of the oil exert direct toxic effects on the tissues of the larvae and pupae which result in their death. The evidence indicates that volatility is directly correlated with toxicity (Freeborn and Atsatt). Oils of low boiling range and high volatility exert a direct toxic action within a very short time. A high boiling, nonvolatile, viscous oil, on the other hand, may slowly cause death within a longer period.

A larvicidal oil should approximate the following specifications as nearly as possible:

Type of Oil:	Light distillate fuel or Diesel
Gravity (A.P. I.)	27-33
Flash Point	130° or higher
Viscosity S. U. (a) 100° F.	35-40
Spreading Coefficient	16 dynes/cm or higher

Distillation:

10%:	430° - 450° F.
50%:	510° - 550° F.
90%:	630° F. or higher

Blends made from fractions of widely divergent volatility and viscosity are likely to be ineffective and uneconomical.

Toxicity:

The toxicity of larvicidal oils can be determined in the field by sampling the larval population of a breeding area before and after spraying, as has been described for paris green. It should be remembered that factors other than the toxicity of the oil may influence the kill.

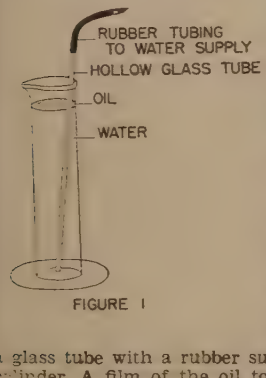

FIGURE 1

The easiest and most simply performed field or laboratory test to determine toxicity is to introduce at least ten (preferably 50) larvae and some pupae into a jar, pan, or other container partially filled with water and then apply a thin surface film of the oil being tested. The time elapsing before the larvae and pupae are dead, or the fact that the larvae and/or pupae are not all killed, indicates the relative toxicity of the oil.

In another test, described by Herms and Gray, the larvae and pupae are placed in a tall glass cylinder not over two inches in diameter, filled with clean water almost to the top. A glass tube which has been connected by means of rubber tubing to a source of water supply is inserted to the bottom of the cylinder (figure 1). Several glass containers filled with water and a glass tube with a rubber suction bulb at one end are placed adjacent to the cylinder. A film of the oil to be tested is put into the water surface in the

cylinder, with as little disturbance as possible. After 30 seconds (using a stop-watch, if available), provided all the larvae and pupae have been in contact with the oil, fresh water is introduced gently through the glass tube to float off the oil, which is finally absorbed with blotting paper or similar material. The larvae and pupae are transferred by means of the glass tube with suction bulb to a jar of clean water. They should then be kept under observation to determine the time of death.

Repeat the experiment, increasing the time of contact by half minute increments up to a total of five minutes. If an oil will not kill within a total contact time of five minutes, it is probably insufficiently toxic to be of use for mosquito control. (Contact time should not be confused with the elapsed time after initial contact with the oil film).

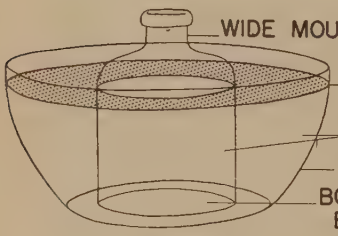

FIGURE 2

The following test as described by W. A. L. David, should result in a mortality of at least 50% when **Aedes aegypti** is the test insect, or at least 90% when **Anopheles quadrimaculatus** is used. The test should be conducted at 77° F.

Take a china or enamel hand bowl about 12 inches in diameter and thoroughly clean it with water (hot water may be used with advantage but avoid the use of soap). Nearly fill the bowl with clean water, bringing the temperature to 77° F. From a bottle having a short neck about 1 inch in diameter remove the bottom at such a level that the mouth of the neck is about 2 inches above the water surface (figure 2).

When the bottle prepared as described is standing in the bowl, put larvicide on the water surrounding the neck. The bowl should be covered with a complete film right up to the edge; if this is not the case, the apparatus was insufficiently washed. For a bowl 12 inches in diameter, use 0.5 ml. larvicide, i.e., enough to form a film about 10 u (u= one-one thousandth mm.) thick.

By following the above technique it is possible to get the larvae under the evenly spread film without any possibility of accidentally oiling them.

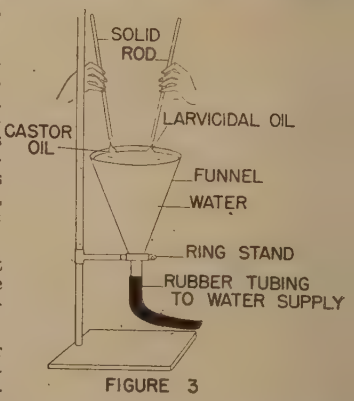

FIGURE 3

Allow the larvae to remain under the oil film for 30 minutes, and then remove them to a clean beaker by running the pipette through the neck of bottle. Remove those at bottom first and if necessary any larvae sticking in the surface film may be caused to sink by touching with a glass rod. Set the beaker aside (preferably at about 77° F.) and observe the larvae after 24 hours. If larvae show no sign of swimming movement after gently touching with a glass rod, they may be considered dead.

(A "control" of equal number of larvae should be prepared and handled in the same manner except exposure to the larvicide. Fifty test larvae will yield more statistically significant data.)

Tests similar to those described above can be used to determine the toxicity of pyrethrum-oil emulsion and other surface acting liquid larvicides.

Spreading Coefficient

The spreading coefficient of larvicidal oil is of fundamental importance since it is an index of water surface coverage, i.e., whether the oil will spread rapidly and evenly so as to produce a thin, uniform, unbroken film on the entire water surface or whether it will remain in thick localized patches. The spreading coefficient of a larvicidal oil should not be less than 16 dynes per cm.

A simple qualitative determination of this property may be obtained by observing carefully the spreading action of the oil when it is applied to actual breeding places, or when a drop or two of the oil is allowed to fall on water in a container of some sort.

A more quantative determination may be made by utilizing castor oil, which has a spreading coefficient of about 16 to 20 dynes per cm. A 6-8 inch diameter glass funnel is fixed in an upright position with the stem connected by rubber tubing to a water supply (figure 3). The apparatus should be set up over a sink or some other receptacle to dispose of the waste water.

Water should be introduced through the rubber tubing and allowed to overflow from the funnel for a short time until a completely clean surface is obtained. The water is then turned off and the funnel tilted slightly and straightened again so as to bring the water surface to about one-eighth inch below the rim of the funnel.

A clean glass rod held in one hand is dipped into the sample to be tested while a rod in the other hand is dipped into castor oil. A drop from each rod is lowered on to the water surface simultaneously. The spreading of the oils is observed by looking along the water surface horizontally.

If both oils occupy an approximately equal area of water surface, their spreading coefficients are about equal (16-20 dynes/cm). If the castor oil spreads over the greater portion of the water surface, the larvicidal oil has a spreading coefficient below 16-20 dynes/cm; if the difference in spread is very great, the larvicide cannot be regarded as satisfactory. The larvicidal oil has a spreading coefficient greater than 16-20 dynes/cm. and is satisfactory when it occupies most of the water surface.

Specific Gravity

Since the oil must form a surface film on the water, the specific gravity of the oil should not approach too closely that of the water. A specific gravity of 0.83 to 0.86 (20° C/4°C) is satisfactory although it may be somewhat higher. A hydrometer can be used to read the specific gravity directly. When a hydrometer is not available gently drop a layer of oil about one-eighth inch thick on the surface of the water in a glass vessel. Stir and allow to stand for about 15 minutes. If the water is clean and the oil/water interface is sharp, the oil may be judged satisfactory.

Viscosity

The viscosity, or resistance of the oil to flow, is of importance since it is concerned with the passage of the oil through the respiratory openings and along the tracheal tubes of the larvae and pupae. If too viscous, penetration is inhibited or retarded. In addition, it is more difficult to spray the thick

heavy oils of higher viscosity. A viscosity range of 35 to 40 (Saybolt Universal at 100°F) is most satisfactory.

Ring the outlet tube of an ordinary 25 to 50 cc. pipette about 2 inches below the bulb with a piece of gummed paper. Prepare a mixture of 60 volumes glycerine (95% pure) and 40 volumes distilled water. Measure the glycerine and water separately and then combine; do not measure 60 volumes glycerine and then add enough water to make 100 volumes.) This mixture has a viscosity of 45* Saybolt Universial at 100° F. Bring the mixture to 70° by cautiously warming over a small flame or cooling if necessary. Draw mixture into pipette, fix the pipette vertically in a clamp and take the time in seconds for the solution to flow from the graduation mark down to the gummed paper ring. Repeat the test and take the average time. If possible, use a pipette with outflow of 30-60 seconds. Clean out pipette, dry, and having brought larvicidal oil to 70° F. run it through in the same way. The time taken should not exceed that for the glycerine/water mixture.

*Viscometer reading by William Spicer, Georgia Institute of Technology.

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MALARIA IN EGYPT

Time (March 13, 1944, p. 28), commenting on the introduction of **Anopheles gambiae** into upper Egypt from the Sudan, reports that the malaria death rate in Qena and Aswan provinces has been unusually high. There is a "prospect that **A. gambiae** may continue its progress north and breed in the myriad ponds and pools of Northern Egypt . . ."

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